Current Horticulture **13**(3): 33–36, July–September 2025
DOI: 10.5958/2455-7560.2025.00037.0
Received: 29 November 2024; Accepted: 17 March 2025

Effect of rootstock girth and varieties of aonla (*Emblica officinalis*) on propagation

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Abstract

Five aonla (*Emblica officinalis* L.), varieties and three rootstock thickness were evaluated for various aspects of propagation under hot semi arid ecosystem of western India during 2010-2013. The rootstock girth and aonla varieties significantly affected all propagation aspects, except survival per cent of budding. The increasing thickness of stock increase plant height, maximum plant height was recorded in Chakaiya (15.06 m), followed by Anand 2 (15.02 m), Francis (14.26 m), Goma Aishwarya (13.02 m) and minimum in N.A. -7 (12.55) at >1.5 cm girth of stock. The maximum plant spread in East-West was recorded in Goma Aishwarya (12.05 m) followed by Franics (11.50 m), Anand 2 (11.02 m), Chakaiya (10.08 m) and minimum in N.A. 7 (10.96m). In case of North-South maximum was noted in Anand 2 (13.50m) followed by Goma Aishwarya (13.05m), Chakaiya (12.06 m), Franics (11.86 m) and minimum in N.A. 7 (11.16m) . The maximum stock and scion thickness were recorded in Anand 2 (66.08 and 63.05cm), followed by Frances (62.22 and 57.33cm), in Chakaiya (52.13 and 49.08 cm) in Goma Aishwarya (50.04 and 47.11 cm) and the minimum in N.A. 7 (44.25 and 44.25 cm). The rootstock and scion growth were equal in NA-7, this variety has more budding compatibility than other.

Key words: *In-situ*, Budding, Rootstock, varieties, scion thickness

Aonla (*Emblica officinalis* L.), is an important minor fruit crop of commercial significance. In *in-situ* budding, existing seedlings or rootstocks were budded after one year. This method is more useful in rainfed areas experiencing hot weather with low precipitation and non availability of genuine planting material. The plants are true-to-type, have shorter juvenile period, can be changed in improved variety after establishment of plants, low mortality, less price and disease and damaged plants can be improved (Singh and Singh, 2007). A lot of work was conducted to see the effect of rootstock age, environment, scion bud maturity, thickness of stocks, skill of budder etc in various crops, (Singh *et al.*, 2009, Chovatia and Singh, 2000, Singh and Singh, 2007, Singh *et al.*, 2003, Silvi *et al.*, 2008, Srivastava *et al.*, 2002, Roshan *et al.*, 2008, Awasthi and Shukla, 2003, Ravindran *et al.*, 2007, Singh *et al.*, 2020). Therefore, an experiment was conducted to find out the effect of rootstock girth on propagation in aonla.

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MATERIALS AND METHODS

The location of experiment is 113 m above msl on latitude 22° 41' 38" N and longitude 73° 33' 22" E and is characterised by hot semi-arid climate. The annual rainfall is mainly confined to three months (July-September) and actual mean precipitation is about 750 mm and total number of rainy days average to about 32. The mean summer temperature is 32.9° C while mean winter temperature is 21.3° C indicating that the area falls under hyperthermic soil regime. The mean annual maximum and minimum temperatures vary from 42 - 44° C (May) and 6 - 9° C (January), respectively. The soil depth of field was 0.65 - 1.0 m derived from mixed alluvial basalt, quartzite, granite and layers of limestone. The three months old rootstocks of aonla were planted at 5m x5 m distance, using the same package and practices were followed in all plants for one year.

After one year of rootstocks plantation during June 2011, the seedlings were tagged as per girth (<1, 1-1.5 and >1.5 cm) of distal end of stock. All the rootstocks were *in-situ* patch budded during June 2011 just before onset of monsoon rain. The genuine and true-to-type bud material of aonla were collected from well managed mother plants. The randomized block design (RBD) with three replications considering ten plants as unit of each treatment (variety and girth) was used. The uniform management practices were adopted for all cultivars. The collected data on per cent survival, rootstock, scion girth, plant height, plant spread (East-West and North-South), number of primary and secondary branches. The statistical analyses of data were carried out using standard method (Snedecer and Cochran, 1989).

RESULTS AND DISCUSSION

All the treatments have irregular effect by rootstocks girth and varieties. Among the varieties, 100 per cent survival was recorded in stock girth >1.5 cm, whereas in N A-7 and Francis rootstock girth significantly affected survival per cent. In case of Goma Aishwarya 100 % survival at 1-1.5 and >1.5 cm stock girth and 93.00 at <1cm was recorded (Fig. 1). In Anand 2, 100 % survival was recorded at <1 and 1-1.5 cm and 93.33 % at >1.5 cm girth. This may be due to survival per cent of budding are depends on season, girth of stock, maturity of bud and skill of budder. All the five varieties are genetically differed and survival per cent may differ. The similar findings are also reported by Singh (2018) and Mulla *et al.* (2011). The maximum plant height in all varieties was recorded at >1.5 cm (Fig. 2). Among varieties, at <1.0 cm stock diameter, maximum plant height was recorded in Anand 2 (13.66 m), followed by Francis (12.88 m), Goma Aishwarya (12.66 m), Chakaiya (10.50 m) and minimum in N.A. -7 (10.13 m), whereas at 1.0-1.5cm the same trend of plant height was recorded (Fig. 2). The maximum plant height at >1.5 cm was noted in Chakaiya (15.06m), followed by Anand 2 (15.02m), Francis (14.26m), Goma Aishwarya (13.02m) and minimum in N.A. -7 (12.55). The NA -7 was found dwarfest and Anand 2 tallest. The results of the study are in close conformity of Singh (2018) and Mulla *et al.* (2011). According to Kumar *et al.* (2016) Anand 2 was tall variety. However, variation in plant height in different cultivars may be attributed to genetic features of individual variety and their adoptability to agro-climatic conditions (Dhandar and Shukla, 2004).

The plant spread and number of branches were significantly affected by varieties and stock girth (Table-1 and Fig 3). Among all stock girth and varieties, plant spread was more in North – South compared to East-West. This may due to plant growth was significantly affected by direction of plantation because of North-South direction the plant got more sunlight as compression to East-West. The plant receive a plenty of sunlight more photosynthesis takes places and resulting the more spread of plants in North-South direction. The similar findings are also reported by Kumar *et al.* (2014). Among the rootstock girths, plant spread (E-W and N-S) was recorded at >1.5 cm girth of stock, followed by 1.0-1.5 and minimum at <1.0 cm in all varieties.

The maximum plant spread in East-West direction (12.05 m) was recorded in Goma Aishwarya, followed by in Francis (11.50 m), Chakaiya (11.08 m), Anand 2 (11.02m) and minimum in N.A. 7 (10.96m). The maximum plant spread in North-South direction (13.50 m) was recorded in Anand 2 followed by Goma Aishwarya (13.05 m), Chakaiya (12.06 m), in Francis (11.86m) and minimum in NA-7 (11.16 m). The more or less similar

Table 1: Effect of rootstock girth and varieties on plant spread (E-W and N-S) of in- situ budding in aonla

Rootstock girth (cm)	Varieties																			
	N.A. -7				Goma Aishwarya				Anand-2				Francis				Chakaiya			
	Plant spread (m)		No. of branches		Plant spread (m)		No. of branches		Plant spread (m)		No. of branches		Plant spread (m)		No. of branches		Plant spread (m)		No. of branches	
	E-W	N-S	P*	S**	E-W	N-S	P*	S**	E-W	N-S	P*	S**	E-W	N-S	P*	S**	E-W	N-S	P*	S**
<1	9.88	10.32	4.36	13.85	9.66	9.93	4.95	14.35	11.03	11.33	4.85	14.65	10.11	10.38	4.55	14.10	6.22	6.82	4.75	14.40
1-1.5	10.13	10.56	4.94	14.55	10.75	10.95	5.15	14.95	11.10	11.66	5.25	15.25	10.33	10.52	5.10	14.85	9.89	10.42	5.20	14.75
>1.5	10.96	11.16	5.23	15.05	12.05	13.05	5.45	16.10	11.02	13.50	5.85	16.35	11.50	11.86	5.45	15.15	11.08	12.06	5.65	16.05
SEm+	0.25	0.25	0.19	0.46	0.23	0.25	0.27	0.44	0.22	0.24	0.28	0.46	0.22	0.26	0.25	0.44	0.24	0.25	0.26	0.45
CV	5.34	5.14	8.78	6.67	5.16	5.21	11.65	5.86	5.19	5.21	11.15	6.71	5.18	5.23	10.16	6.42	5.14	5.27	9.53	6.39
CD-(5%)	0.81	0.82	0.81	1.49	0.83	0.84	0.91	1.23	0.86	0.87	0.87	1.28	0.82	0.84	0.86	0.123	0.86	0.85	0.88	1.26

*No. of primary branches,** No. of secondary branches

Table-2 Effect of rootstock girth and varieties on rootstock girth and scion diameter *in- situ* budding in aonla

Rootstock girth (cm)	Varieties (%)									
	N.A. -7		Goma Aishwarya		Anand-2		Francis		Chakaiya	
	Rootstock girth (cm)	Scion diameter (cm)	Rootstock girth (cm)	Scion diameter (cm)	Rootstock girth (cm)	Scion diameter (cm)	Rootstock girth (cm)	Scion diameter (cm)	Rootstock girth (cm)	Scion diameter (cm)
<1	41.86	41.86	42.33	39.08	56.33	44.04	38.91	37.07	37.12	34.07
1-1.5	45.24	45.24	46.26	43.66	48.61	54.33	42.88	41.28	45.81	39.20
>1.5	44.25	44.25	50.04	47.11	66.08	63.05	62.22	57.33	52.13	49.08
SEm+	0.92	0.65	1.24	0.98	1.09	0.47	0.88	1.30	0.92	0.80
CV	4.71	3.32	6.03	5.06	4.27	1.96	4.14	6.42	4.55	4.38
CD-(5%)	3.0	2.12	4.03	3.19	3.55	1.53	2.89	4.24	2.99	2.60

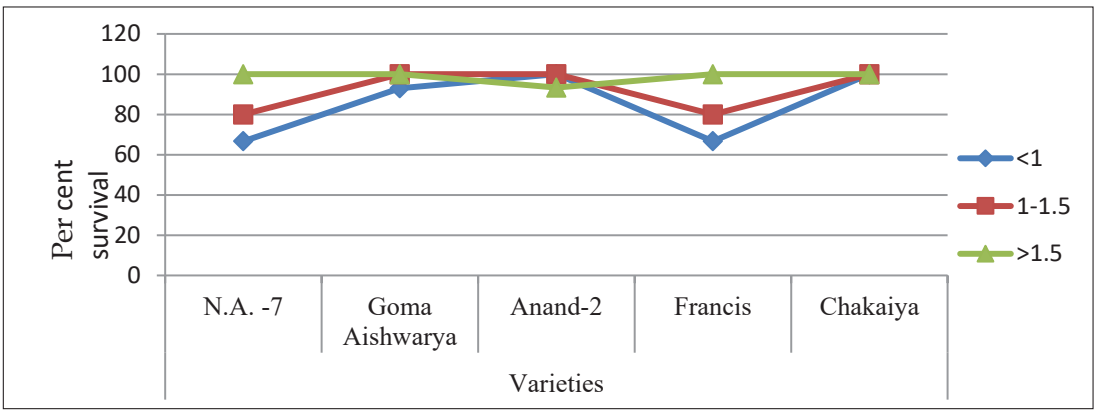

Fig.1 Effect of rootstock girth and varieties on survival per cent of *in- situ* budding in aonla

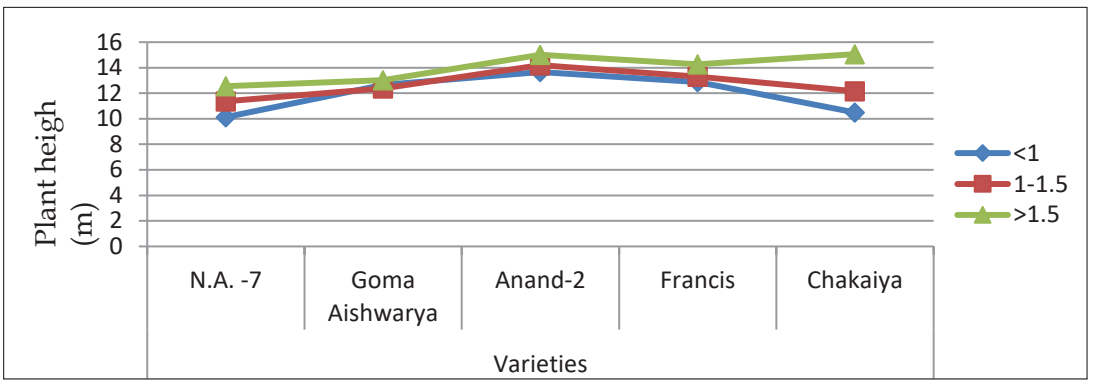

Fig.2 Effect of rootstock girth and varieties on plant height of *in- situ* budding in aonla

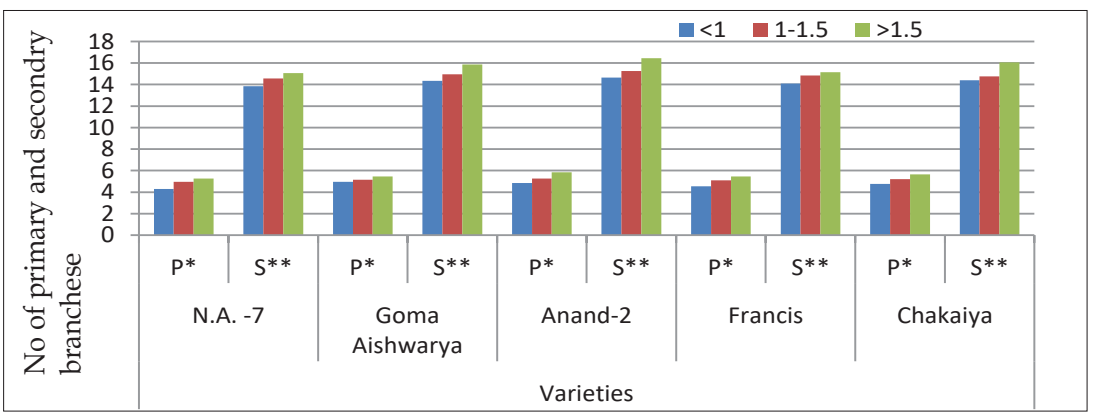

Fig.3 Effect of rootstock girth and varieties on number of primary and secondary branches in- situ budding in aonla

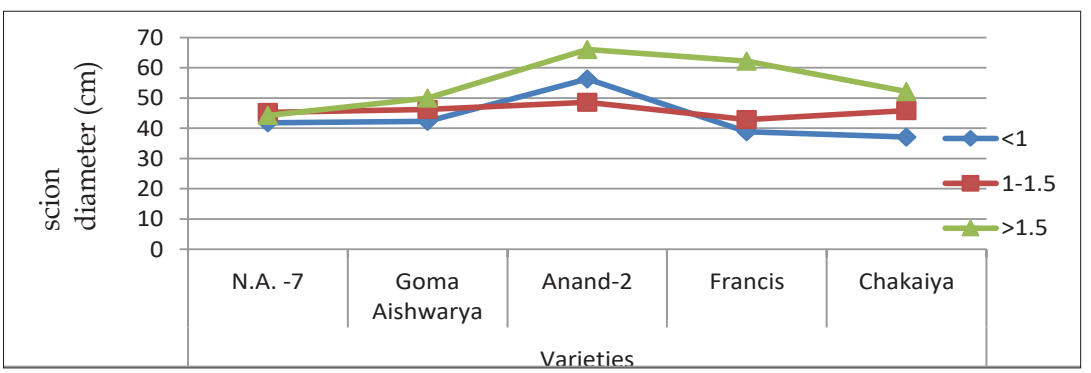

Fig.4 Effect of rootstock girth and varieties on girth of scion *in- situ* budding in aonla

findings are also reported by Dhandar and Shukla, (2004). All the treatments showed significant effect on number of primary and secondary branches. The increase stock girth significantly increased the primary and secondary branches in all varieties.

This may be due to initial strong plant may develop faster and produce more number of branches. The maximum primary (5.85) and secondary (16.35) branches were recorded in Anand 2, followed by Chakaiya (5.65 and 16.05), Goma Aishwarya (5.45 and 16.10), Francis (5. 45 and 15.15) and the same was minimum (5.23 and 15.05) in N.A. -7. However, variation in plant in different cultivars may be attributed to genetic features of individual variety and their adoptability to agroclimatic conditions (Dhandar and Shukla, 2004) and Kumar *et al.* (2014).

Varieties and girth of rootstock significantly affected girth of stock. The increasing stock diameter significantly increased girth of rootstock, maximum was recorded at >1.5 cm, followed by 1.0-1.5 cm and minimum at <1.0 cm in all varieties (table-3). Among the varieties, the maximum stock girth (66.08 cm) was recorded in Anand 2 followed by Francis (62.22 cm), Chakaiya (52.13 cm), Goma Aishwarya (50.04 cm) and minimum in NA -7 (44.25 cm). This may be due to the higher initial stock girth significantly having more root biomass per unit and uptake more nutrients and moisture from larger area and increase plant growth.

The results of the present study are in accorded to Srivastava *et al.* (2002). Aonla varieties and rootstock girths significantly affected the scion diameter. Among stock diameter, maximum scion diameter was recorded >1.5 cm stock diameter (Table-2 and Fig. 4). Among the varieties the maximum scion diameter was noted in Anand 2 (63.05cm) followed by in Francis (57.33 cm), in Chakaiya (49.08cm), in Goma Aishwarya (47.11 cm) and minimum in N. A. -7 (44.25 cm). This may be due to the higher initial stock girth significantly having more root biomass per unit and uptake more nutrients and moisture from larger area and increase plant growth. It is also revealed from the study among the varieties the rootstock and scion growth was equal in NA-7, it means, this variety is more budding compability than other tested varieties. The results of the present study are in accorded to Kumar *et al.* (2016) in aonla. The similar findings are also reported by Roshan *et al.* (2008) in aonla and Singh *et al.* (2003) in lasoda.

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